

Digestion and absorption of lipids: From fats to fatty acids.

Food is a fundamental part of living which assists growth, repair, and function of the human body. It is built up of macronutrients “consumed in largest quantities mainly classified in carbohydrates, protein and fats” (Savarino et al, 2021) and micronutrients, although needed in smaller quantities, are essential for growth. According to La Pelusa (2022) “Proteins are biopolymeric structures composed of 20 amino acids” the body then uses these amino acids to help build and repair muscles whilst producing hormones and enzymes. Carbohydrates are also important “as an energy source which also helps control blood glucose and insulin” (Holesh, 2023). The final macronutrient is lipids also known as fats, which cushion organs and store energy in the form of body fat. Unlike carbohydrates and proteins, lipids are not water-soluble and require specific mechanisms for digestion. In this assignment, the stages involved in the digestion and absorption of lipids, highlighting the roles of enzymes, bile and intestinal lining will be discussed.

The process of fat digestion begins in the mouth. Salivary glands secrete salivary lipase, an enzyme that begins the hydrolysis of triglycerides. However, the effect of salivary lipase is relatively minor since the enzyme is inactive at the pH of the mouth (Peyrot des Gachons, 2016). In the stomach, gastric cells secrete gastric lipase, an enzyme that further begins break down triglycerides, converting them into diglycerides and free fatty acids (Pirahanchi, 2023) When fats enter the small intestine, they encounter bile, a substance produced by the liver and stored in the gallbladder (Omer, 2024). Bile contains bile salts, which are crucial for emulsifying fats. Emulsification is the process where large fat globules are broken into smaller droplets, increasing the surface area of the action of lipase. After the action of pancreatic lipase, the resulting monoglycerides, free fatty acids, and bile salts form micelles. These micelles are small, water-soluble particles that help keep fat molecules (which are hydrophobic) to remain in the waterlike environment of the small intestine. They make it easier for the body to absorb the broken-down fats into the intestinal cells (Iqbal, 2009). The micelles transport the fatty acids and monoglycerides to the enterocyte by simple diffusion. Inside the enterocyte, they are reassembled to form triglycerides again (Callahan, 2020), the reformed triglycerides then combine with cholesterol, phospholipids, and proteins to form chylomicrons. These are too large to enter the bloodstream directly therefore must enter the lymphatic system then to the bloodstream through the thoracic duct. The free fatty acids released from chylomicrons are taken up by adipose tissue and converted into triglycerides for storage. These triglycerides serve as an energy reserve. Fatty acids can also be utilised for energy production, especially by muscle tissue, by undergoing beta oxidation within the mitochondria, generating ATP (Scientia Educare, 2025).

Studies involving lipid absorption disorders like celiac disease or pancreatic insufficiency highlight the importance of bile and pancreatic enzymes in the digestive process. In these conditions, fat malabsorption occurs due to inadequate bile secretion or lipase activity, leading to nutrient deficiencies. Celiac disease is an autoimmune disorder where the ingestion of gluten damages the small intestine's lining, impairing nutrient absorption. This damage can disrupt the normal digestive processes, leading to malabsorption of fats and a strict gluten-free diet allows intestinal healing. According to Zuvarox (2023) "impaired nutrient absorption is often located along the small intestine" as this area of the body has the largest surface area used by villi and microvilli, which can lead to a larger global impairment of absorption of all nutrients. Pancreatic insufficiency occurs when the pancreas does not produce sufficient digestive enzymes, including lipases essential for fat digestion. This deficiency leads to incomplete breakdown of dietary fats, resulting in steatorrhea with the best treatment being pancreatic enzyme replacement therapy to aid in the digestion and absorption of fats (

The digestion and absorption of fats involve a sequence of well-coordinated processes starting from the breakdown in the mouth to the final transport of absorbed lipids via chylomicrons. Enzymes like salivary lipase, gastric lipase, and pancreatic lipase, along with salts for emulsification, play essential roles in breaking down fats. The absorbed lipids are then packaged into chylomicrons for transport throughout the body.